(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 April 2002 (18.04.2002)

PCT

(10) International Publication Number
WO 02/30194 A1

(51) International Patent Classification[7]: A01N 25/00, 31/16, 37/40, A61K 7/48, B27K 3/38, 3/40, A23L 3/34, 1/03, 7/00, C14C 9/00, 11/00

(21) International Application Number: PCT/FI01/00887

(22) International Filing Date: 12 October 2001 (12.10.2001)

(25) Filing Language: Finnish

(26) Publication Language: English

(30) Priority Data:
20002245 12 October 2000 (12.10.2000) FI

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EC, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 02/30194 A1

(54) Title: ANTIMICROBIAL POLYALPHAOLEFIN COMPOSITION

(57) Abstract: The present invention relates to an antimicrobial polyalphaolefin composition comprising polyalphaolefin and trichlosan and/or paraben as antimicrobial compound(s). The composition may be used either as such in various applications, or as a starting material for producing products that should have antimicrobial properties.

Antimicrobial polyalphaolefin composition

The present invention relates to an antimicrobial polyalphaolefin composition comprising polyalphaolefin and an antimicrobial compound. The composition may be used either as such in various applications, or as a starting material for producing products that should have antimicrobial properties.

Various antimicrobial formulations such as solutions, compositions for cleaning purposes and like are commonly used to desinfect surfaces and instruments. In technochemical, cosmetics, pharmaceutical and food industries as well as in hospitals, antimicrobial products are used to prevent the growth of microbes such as bacteria, fungi, moulds, and yeasts. Further, said products are used to control the health risk, and the deterioration of products and the development of bad odour therein and the discolouration thereof due to microbes. In food industry, problems are caused by the protecting and lubricating oils used in machines and apparatuses allowing microbial e.g. *Listeria* bacterial growth under favourable conditions. Droplets of such contaminated lubricating oil entering the products form a serious health hazard.

Patent NO 180104 discloses a liquid silicone oil containing antibacterial agents such as triclosan, and the use thereof to fill dental cavities in connection with dental bridges and prosthesis.

Patent publication JP 07021091 presents a microbicidal polyolefin composition comprising polyolefins containing chlorine compounds, bactericidal compounds, phosphorus compounds, phenolic compounds and neutralizing compounds.

U.S. Patent 5,069,907 discusses cloth materials used in surgery. This material consists of synthetic polymer film or a cloth containing 0.01 – 25 % by weight of an antimicrobial agent, preferably 2,4,4'-trichloro-2'-hydroxyphenyl ether. Alternatively, the cloth may comprise so-called fastening agent between the skin and the cloth, mixed with said antimicrobial agent. Suitable fastening agents are the following: polyvinyl ether, acrylic binder, polyolefin, silicone binder, polyester, and polyurethane.

Patent application WO 99/37710 is directed to polymeric compounds containing at least one phenolic compound in an amount of 0.01 to 10 % by weight, the corresponding master batch, and the production and use thereof. The polymeric compounds mentioned include polyolefins selected in this case from: polyethylene and the derivatives thereof, LDPE, HDPE, LLDPE, EVA, EBA, EEA, EAS, EVK, ETFE, PEC, CSM, VPE, EPB, EPDM, ERM, polybutylene, and polyisobutylene. Phenolic compounds preferably mean 2,4,4'-trichloro-2'-hydroxyphenyl ether. Such end uses as boxes, containers and waste containers for storage and transportation are mentioned

Patent application FI 971338 discloses coatings of structures and profiled articles containing a mixture of thermoplastic elastomer with a non-elastomeric polyolefin, in general with homopolymers or random copolymers of propylene. An oligomer of poly-α-olefine type is used as the polyolefin plastisizer in a matrix plastic (EPR, EBR, EPBR, PBR, SBR, EPM, EPDM). The monomers used comprise at least 3 carbon atoms, preferably 6 to 12 carbon atoms. For example, reference is made to U.S. Patent 4,032,591 and EP Patent 318186 wherein 1-decene is mentioned.

Patent application WO 99/27792 discloses a concentrate containing biocides comprising zinc pyridine and another biocide, preferably a halogenated phenol, preferably

25 to 45 % by weight of 2,4,4'-trichloro-2'-hydroxyphenyl ether. Cleaning devices and plastic materials are mentioned as end uses. In addition, the production thereof is disclosed. The biocidal compound is dissolved in a plastisizer to be added to the polymer being produced. Suitable plastisizers are polybutylene, LDPE, LDPP, and paraffin wax.

Polyalphaolefins are liquid oils, the starting materials of which are monomers having most suitably 8 to 12 carbon atoms. The most common starting material is the decene (C_{10}).

The term polyolefin refers to all such thermoplastics wherein the carbon skeleton of the polymer is formed by polymerizing monomers having carbon-carbon double bonds. In this polymerization, these double bonds are opened to form carbon-carbon bonds between the monomers. These polyolefins include for instance polyethylene, polypropylene, EPR, SBR, EBA, EMA, and EVA.

The object of the present invention is to provide an antimicrobial polyalphaolefin composition comprising polyalphaolefin and antimicrobial compound/compounds, and the use of this antimicrobial polyalphaolefin composition for various applications.

The characteristic features of the antimicrobial polyalphaolefin compositions of the present invention, and the uses thereof are disclosed in the appended claims.

It is found that colourless, odourless, tasteless and clear antimicrobial polyalphaolefin compositions may be produced from polyalphaolefins, preferably from polydecenes, and more preferably from food grade hydrogenated polydecenes by adding to this polydecene 0.01 to 30 % by weight of 2,4,4'-trichloro-2'-hydroxydiphenyl ether (triclosan), or 0.01 to 5 % by weight of n-propyl ester of hydroxybenzoic acid, or n-

methyl ester of hydroxybenzoic acid (paraben) or mixtures thereof, optionally by using heat.

Particularly preferable polydecenes are food grade polydecenes NEXBASE™ 2004FG, NEXBASE™ 2006FG, and NEXBASE™ 2008FG (Fortum Oil and Gas Oy). 0.01 to 30 % by weight of triclosan and/or 0.01 to 5 % by weight of paraben may be dissolved in polydecene at the temperature of 10 to 90 °C depending on the concentration desired. Thus, an oily antimicrobial composition is obtained that is suitable for several applications in foor, pharmaceutical, technochemical, and cosmetics industry, and in hospitals. Further, it may also be used as an antimicrobial plastisizer in the plastics industry.

The composition of the invention may be used in food industry as a protecting and lubricating oil for machines to prevent in the oil the growth of microbes that are unwanted and hazardous to health, and further, to prevent the passing thereof from the oil to the products. Said antimicrobial compositions may also be used as protecting and lubricating oils of apparatuses in pharmaseutical industry to reduce any contamination risk. The antibacterial polyalphaolefin composition of the present invention may be used as such as a skin care oil and as a product to be applied on the skin in connection with the use of prostheses before the disposition thereof to prevent the microbial growth under the prostheses and unpleasant odour, and for other similar applications in connection with the use of prostheses. The antimicrobial composition of the invention may also be used to impregnate various wooden surfaces and wooden products particularly under circumstances where it is very important to prevent the unwanted growth of microbes and the deterioration of the wooden surface. Tooth picks impregnated with the composition of the invention may be mentioned as an example for such use. Moreover, the composition of the invention may be used to treat and polish leather.

The composition is also particularly useful as an antimicrobial plastisizer to simultaneously improve the antimicrobial properties of rubber mixtures, thermoplastic elastomers, thermoplastic vulcanizates and silicones. Plastisizing agents and oils are used in rubber mixtures (a), thermoplastic elastomers (b), vulcanizates thereof (c) and silicones (d) to plastisize the hardness of the product and to provide more flexible products having a soft surface and a lower residual compression, the products being suitable for lower working temperatures.

(a) Normally plastisized rubbers (elastomers):

EPR = ethylene-propylene rubber

EPDM = ethylene-propylene-diene rubber

NR = natural rubber

IIR = butyl rubber

ACM/EAM = polyacrylate rubber

SBR = styrene-butadiene rubber

1,2-sPB = 1,2-syndiotactic polybutadiene rubber.

(b) Plastisized thermoplastic elastomers; polypropylene commonly as a crystalline thermoplastic in a mixture:

SBC = styrene-butadiene blockcopolymers,

unhydrogenated version	hydrogenated version
SBS	SEBS
SB	SEB
SI	SEP

EPR = ethylene-propylene rubber

EPDM = ethylene-propylene-diene rubber

NR = natural rubber

IIR = butyl rubber

ACM/EAM = polyacrylate rubber
SBR = styrene-butadiene rubber
1,2-sPB = 1,2-syndiotactic polybutadiene rubber.

(c) Thermoplastic vulcanizates:
Vulcanization is accomplished while mixing either by means of a sulfur compound, organic peroxide, or with a phenolic resin according to the type of the elastomer.

(d) Silicones.

In many cases, the use of a plastisizer lowers the raw material costs of the products and improves the processibility thereof. An advantage attained with the addition of a plastisizer is the improvement of the collapse resistance of an article made of thermoplastic elastomer exposed to oil in the environment. Plastisizers present in the product reduce the ability thereof to absorb additional hydrocarbons.

No plastisizers may be used in crystalline plastics since the crystalline structure will not tolerate the presence of an oil. Unplastisized plastics typically include polycarbonates, polyolefins (PE and PP), polyamides and polyurethanes. Compounding these plastics with elastomers provides in certain cases mixtures that may be plastisized.

With respect to performance, polyalphaolefins have several advantages in plastisizing applications. For instance:

- superior heat resistance is an important feature in medical apparatus and device applications requiring repeated sterilization or heating of the article in a microwave oven, for instance as a component of a food tray. There are also other appli-

cations profiting from the high heat resistance, such as cable applications and engine room applications in automobile industry.

- strictly limited composition, that is, a narrow molecular weight distribution allows for the selection of the desired molecular weight, thus minimizing the evaporation effects of the plastisizing agent or oil. In addition, the flash point of polyalphaolefin is generally higher at the desired viscosity than that of conventional mineral oils, this being favourable for processing. With respect to its quality, polyalphaolefin is a pure product, thus often facilitating the approval by the authorities.

- a low working temperature is an important characteristic of polyalphaolefins. They crystallize at very low temperatures, thus making possible to lower the brittle temperature of rubber or a thermoplastic elastomer. This property is particularly advantageous for styrene elastomers. In applications of the automobile industry, the required lowest working temperature is commonly below –40 °C.

Since 2,4,4'-trichloro-2'-hydroxyphenyl ether (triclosan) is very soluble in polyalphaolefins, a triclosan concentration necessary for the improvement of the antimicrobial properties of an elastomer products may be attained in plastisizer application. Moreover, the antimicrobial spectrum of triclosan is very wide, as the Table 1 below shows. By combining this wide spectrum antimicrobial activity with the favourable properties of polyalphaolefins, a composition particularly suitable for medical and medicinal apparatus and device applications and for seals of food packages is obtained.

Table 1

Microbiostatic effect of triclosan (Irgaguard B 1000)

Gram-positive bacteria	Origin	Strain No.	Medium	IRGAGUARD B 1000 [ppm]	Comment
Actinomyces bovis	A		NA	1.0	
Actinomyces israelii	NCTC	8047	NA	1.0	
Actinomyces naeslundii	A		NA	1.0	
Bacillus cereus	A		NA	3.0	
Bacillus cereus var. mycoides	A		NA	3.0	
Bacillus megatherium	A		NA	3.0	
Bacillus subtilis	NCTC	8236	NA	0.1	
Clostridium botulinum	NCTC	3805	EA	3.0	
Clostridium difficile	ATCC	9684	BHI-A	5.0	
Clostridium perfringens	NCTC	3110	EA	10.0	
Clostridium sporogenes	A		EA	10.0	
Clostridium tetani	NCTC	9571	EA	3.0	
Corynebacterium acnes*	ATCC	6919	BHI-A	3.0	
Corynebacterium diphtherias	NCTC	3984	BHI-A	3.0	
Corynebacterium minutissimum	ATCC	23348	BHI-A	3.0	
Corynebacterium xerosis	ATCC	373	M-H	5.0	
Enterococcus faecalis	ATCC	29212	M-H	4.0	
Enterococcus faecalis	ATCC	6055	M-H	5.0	
Enterococcus faecalis	NCTC	12201	M-H	5.0	Varicomycin resistant
Enterococcus faecalis	NCTC	12203	M-H	5.0	Varicomycin resistant
Enterococcus faecium	ATCC	10541	BHI-A	3.0	
Enterococcus faedium	NCTC	8619	BHI-A	10.0	
Enterococcus faedium	ATCC	6057	M-H	4.0	
Enterococcus arabinosus	ATCC	8014	MACA	33.0	
Lactobacillus delbrueckii	ATCC	7830	MACA	33.0	
Lactobacillus fermenti	ATCC	707	MACA	33.0	
Lactobacillus rhamnosus	NCTC	7469	MACA	33.0	
Listeria monocytogenes	ATCC	15313	BHI-A	1.0	
Micrococcus luteus	ATCC	7468	M-H	4.0	
Mycobacterium phlei	A		BHI-A	0.3	

Gram-positive bacteria	Origin	Strain No.	Medium	IRGAGUARD B 1000 [ppm]	Comment
Mycobacterium smegmatis	NCTC	8152	BHI-A	1.0	
Mycobacterium tuberculosis	A		YA	100.0	
Nocardia asteroides	NCTC	6761	BHI-A	3.0	
Sarcina lutee	NCTC	196	BHI-A	3.0	
Sarcina urea	ATCC	6473	BHI-A	0.1	
Sporosarcina urea	ATCC	6473	BHI-A	0.1	
Staphylococcus aureus	ATCC	29213	M-H	<0.125	
Staphylococcus aureus	NCTC	6571	NA	0.03	
Staphylococcus aureus	ATCC	9144	M-H	0.05	
Staphylococcus aureus	NCTC	6966	NA	0.1	
Staphylococcus aureus	ATCC	13709	NA	0.01	
Staphylococcus aureus	ATCC	6538	NA	0.01	
Staphylococcus aureus	NCTC	11940	M-H	0.01	Methicillin resistant
Staphylococcus aureus	NCTC	12232	M-H	0.01	Methicillin resistant
Staphylococcus aureus	NCTC	12493	M-H	0.01	Methicillin resistant
Staphylococcus aureus	NCTC	12497	M-H	0.01	Methicillin resistant
Staphylococcus aureus	NCTC	10443	M-H	0.01	Methicillin resistant
Staphylococcus aureus	NCTC	10703	M-H	0.01	Methicillin resistant
Staphylococcus aureus	NCTC	11150	M-H	0.02	Methicillin resistant
Staphylococcus albus	NCTC	7292	NA	0.1	
Staphylococcus epidermidis	ATCC	12228	M-H	<0.125	

Gram-positive bacteria	Origin	Strain No.	Medium	IRGAGUARD B 1000 [ppm]	Comment
Staphylococcus hominis	ATCC	27844	M-H	1.0	
Staphylococcus hyicus	NCTC	7944	BHI-A	0.03	
Staphylococcus lactis	NCTC	8340	NA	3.0	
Staphylococcus saprophyticus	NCTC	7292	NA	0.1	
Streptococcus agalactiae	NCTC	8181	BHI-A	3.0	
Streptococcus heamolyticus A	A		BHI-A	3.0	
Streptococcus pneumoniae	ATCC	33400	M-H	4.0	
Streptococcus pyogenes	ATCC	21059	M-H	4.0	
Streptococcus saprophyticus	ATCC	15305	M-H	0.125	
Streptococcus coelicolor	A		BHI-A	1.0	

Gram-negative bacteria	Origin	Strain No.	Medium	IRGAGUARD B 1000 [ppm]	Comment
Aerobacter arogenes	CITM	413	NA	1.0	
Acinetobacter lwoffii	ATCC	15309	M-H	0.125	
Alcaligenes faecalis	A		NA	>100	
Bacteroides fragilis	ATCC	23745	M-H	2.0	
Brucella abortus	NCTC	8226	BR.A.A.	0.1	
Brucella intermedia	A		BR.A.A.	0.1	
Citrobacter freundii	A		NA	3.0	
Enterobacter aerogenes	ATCC	13048	M-H	0.5	

Gram-negative bacteria	Origin	Strain No.	Medium	IRGAGUARD B 1000 [ppm]	Comment
Enterobacter cloacae	ATCC	13047	M-H	0.5	
Enterobacter sakazakii	NCTC	8155	NA	0.3	
Escherichia coli	NCTC	9663	NA	0.3	
Escherichia coli	NCTC	11186	M-H	0.5	Tobramicin resistant
Escheria coli	ATCC	8196	M-H	0.02	
Escherichia coli	ATCC	9661	NA	0.3	
Escherichia coli	ATCC	11229	M-H	0.5	
Escherichia coli	ATCC	25922	M-H	0.25	
Escherichia coli	ATCC	10536	BHI	0.5	
Escherichia coli	ATCC	35150	M-H	0.2	Serotype 0157
Escherichia coli	ATCC	4388	M-H	0.1	Serotype 0157
Escherichia coli	ATCC	43889	M-H	0.2	Serotype 0157
Escherichia coli	ATCC	43890	M-H	0.2	Serotype 0157
Haemophilius influenca	ATCC	33391	B-A	2.0	
Klebsiella aerogenes	NCTC	8172	NA	0.3	
Klebsiella edwardsii	NCTC	7242	NA	0.3	
Klebsiella oxytoca	ATCC	43165	M-H	1.0	
Klebsiella pneumoniae	ATCC	4352	NA	0.3	
Klebsiella pneumoniae	ATCC	10031	M-H	0.125	
Loefferella mallei	NCTC	9674	NA	0.3	
Loefferella pseudomallei	NCIB	10230	NA	1.0	
Moraxella glucidolytica	A		NA	0.3	
Moraxella lwolffii	A		NA	0.1	
Neisseria catarrhalis	NCTC	3622	BA	33.0	
Pasteurella pseudotuberculosis	C-G		NA	10.0	
Pasteurella septica	NCTC	948	NA	0.1	
Proteus mirabilis	ATCC	14153	M-H	0.5	
Proteus vulgaris	NCTC	8313	NA	0.1	
Proteus vulgaris	NCTC	4636	NA	0.3	
Pseudomonad aeruginosa	ATCC	12055	NA	>1000	
Pseudomonas aeruginosa	NCTC	8060	NA	>1000	
Pseudomonas fluorescencens	NCTC	4755	NA	>100	

Gram-negative bacteria	Origin	Strain No.	Medium	IRGAGUARD B 1000 [ppm]	Comment
Salmonella enteritidis	A		NA	0.1	
Salmonella paratyphi A	NCTC	5322	NA	0.3	
Salmonella paratyphi B	NCTC	3176	NA	0.3	
Salmonella paratyphi B	NCTC	5704	NA	0.1	
Salmonella typhimurium	NCTC	5710	NA	0.3	
Salmonella typhi	NCTC	8384	NA	0.3	
Salmonella typhi	NCTC	786	NA	0.3	
Serratia marcescens	ATCC	14756	M-H	>512	
Shigella dysenteriae	NCTC	2249	NA	0.1	
Shigella flexneri	NCTC	8192	NA	0.3	
Shigella flexneri	NCTC	8204	NA	0.1	
Shigella sonnei	NCTC	7240	NA	0.1	

Gram-negative bacteria	Origin	Strain No.	Medium	IRGAGUARD B 1000 [ppm]	Comment
Vibrio cholerae	A		NA	10.0	
Vibrio eltor	NCTC	8457	NA	10.0	

Molds and yeast	Origin	Strain No.	Medium	IRGAGUARD B 1000 [ppm]	Comment
Aspergillus fumigatus	ATCC	9197	SMA	10	
Aspergillus niger	ATCC	6275	M	30	
Candida albicans	ATCC	10259	M	3	
Candida albicans	A		SMA	10	
Candida paracrusei	A		SMA	4	
Candida parapsylosis	A		SMA	30	
Candida stellatoidae	A		SMA	10	
Candida tropicalis	A		SMA	10	
Candida tropicalis	DSM	1346	M-H	10	
Candida utilis	A		SMA	33	
Epidermophyton floccosum	ATCC	10227	SMA	1-10	
Keratinomyces ajelloi	A		SMA	10	
Microsporum canis	ATCC	10214	SMA	3	
Pityrosporum ovalae	ATCC	14521	M	>1000	
Trichophyton cutaneum	A		SMA	10	
Trichophyton mentsgrophytes	ATCC	9533	SMA	1	
Trichophyton rubrum	A		SMA	10	
Trochophyton tonsurans	A		SMA	10	

Key

Media		Origin	
NA	Nutrient Agar	CITM	official culture collection
BA	Blood Agar	DSM	German Collection of Microorganisms (Germany)
BR.A.A.	Brucella Agar Albimi	NCTC	National Collection of Type Culture (UK)
MACA	Micro Assay Culture Agar	ATCC	American Type culture collection (USA)
BHI-A	Brain Heart Infusion Agar	C-G	Ciba
EA	Eugon Agar	A	Bacteriological or veterinary Institutes
YA	Youmans Agar		
M	Mycophil Agar		
SMA	Sabouraud Maltose Agar		
M-H	Muller Hinton Agar		

Elastomers and plastics used in medical applications and having a very high compatibility with polyalphaolefins include:

Type of plastic	Most common plastisizers	Compatibility with polyalphaolefins
PP/EPDM	Paraffin oil, naphtalene oil	Very high
PP/SBC	Paraffin oil, naphtalene oil	Very high

Next, the use of antimicrobial polyalphaolefin composition of the invention as plastisizing agents in plastics is discussed in more detail.

1. Use of an antimicrobial polyalphaolefin composition in elastomers:
PP/EPDM or PP/EPR blend

Raw material	%, by weight	
EPDM or EPR	5 to 80	
Polypropylene	15 to 90	
Plastisizer 1	5 to 30	polyalphaolefin
Plastisizer 2	0 to 35	mineral oil
Antimicrobial compound	0.1 to 30	triclosan
Antioxidant	0 to 0.3	
Peroxide	0 to 0.1	di-tert-butyl peroxide
Internal lubricant	0 to 0.2	magnesium stearate

2. Use of a antimicrobial polyalphaolefin composition in styrene based thermoplastic elastomer: SEBS blend.

Raw material	% by weight	
SEBS	30 to 50	
$CaCO_3$	0 to 20	
Polypropylene	0 to 30	
Plastisizer 1	5 to 30	polyalphaolefin
Plastisizer 2	0 to 35	mineral oil
Antimicrobial compound	0.1 to 30	triclosan
Antioxidant	0 to 0.3	

The combination PP/SEBS is generally used in those applications of styrene elastomers that are more demanding with respect to working temperature and environmental pollution.

Typical medical uses of elastomers are syringes and needles, intravenous, urinary catheters, dosage tubings and devices, clinical cardiac valves and vessel implants, disposable packages and trays.

The antimicrobial polyalphaolefin composition of the invention has several advantages. At lower concentrations of the antimicrobial agents, preferably at 0.01 to 5 %, more preferably 0.1 to 2 % by weight, the composition may be used as a skin oil, or on the skin in connection with prosthesis, and further, to impregnate leather and wooden surfaces. According to studies, reddening, abrasion, callousness and infections of the skin are reduced by more than 80 % among carriers of prosthesis. Thus, the spreading and growth of microbes and the accompanying health risk may be prevented, and the deterioration of products hindered.

In food and pharmaceutical industry, contamination of products by unwanted microbes is both a serious economic risk factor and a health hazard to the consumers. The risk of microbial contamination may be reduced and prevented by using the antimicrobial polyalphaolefin composition of the invention containing 0.1 to 5 %, preferably 0.1 to 2 % by weight of the antimicrobial agent as the protecting and lubricating oil in apparatuses wherein the oil may find its way into the product contacting them.

In skin care applications, moisturizing and repairing properties of the antimicrobial polyolefin may be improved by adding vitamin compounds (retinyl palmitate or vitamin A, and tocopherol acetate or vitamin E) soluble in fat. As in known, vitamins A and E effectively moisturize of the skin, alleviate effects due to ageing, and promote the renewal thereof. Vitamin E is also an antioxidant.

Antimicrobial polyalphaolefin oil containing vitamins may be used as plastisizer for instance in silicone materials and elastomers. It is possible to produce a material exuding oil that is very comfortable in use. For instance, it may be used to treat wounds and burns since it will not stick to the skin and has nourishing properties.

In plastisizer applications, the antimicrobial polyalphaolefin composition has important advantaged, including the possibility to incorporate antimicrobial triclosan into plastic in an amount of 0.01 to 30 % by weight, and/or a desired amount of paraben dissolved in polydecene. Further, the ratio of polydecene to antimicrobial agent may be freely adjusted by means of optional heat during dissolution of the agent, and the amount of polydecene. The composition optionally having a temperature of 10 to 90 °C may be mixed to elastomers and plastics during the production thereof preferably to obtain a content of triclosan of 0.1 to 1.0 % by weight of the plastic product. In this manner, the preparation of separate "master batches" is avoided, thus lowering the costs and reducing process steps. Elastomer and plastic products particularly useful in medical and medicinal apparatus applications are thus obtained. In such final uses, it is extremely important to be able to prevent and/or reduce growth of unwanted microbes on apparatuses and devices, thus considerably lowering the costs due to infections caused by such unwanted microbes among patients. Medical applications have several special requirements on materials such as resistance to sterilization. These requirements are restricted in no way by the composition of the invention.

The invention will now be illustrated in more detail with the following examples without wishing to limit it to these exemplary solutions.

Example 1

Bacteriostatic effect of the antimicrobial polydecene composition

The antimicrobial composition of the invention comprised hydrogenated polydecene and 0.3 % by weight of triclosan. The activity of the composition was tested and the composition was found to have a bacteriostatic efffect on *Staphylococcus aureus* NCTC4163, *Escherichia coli* NTCT10538, *Klebsiella pneumoniae* ATCC27736, and *Proteus vulgaris* NTCT4635 strains.

Example 2

Tooth picks were impregnated with an antimicrobial polydecene composition of the invention containing 0.3 % by weight of triclosan. The picks were then cultivated on a plate with the bacterium *Staphylococcus aureus*. It was found that the growth of the bacteria was effectively inhibited.

A photo of a cultivation plate of the tooth picks is shown in Figure 1.

Use of antimicrobial polyalphaolefin composition in plastisizers

Example 3

Elastomer: EPDM or PP/EPR blend

Raw material	% by weight	Products
EPDM or EPR	59.8 / 59.5	Vistalon 805 / Nordel IP 3745P
Polypropylene	29	Escorene PP 4152
Plastisizer 1	10	polydecene
Plastisizer 2	0	mineral oil
Antimicrobial agent	0.3	triclosan
Antioxidant	0.3	Irganox B-225
Peroxide	0.1	di-tert-butyl peroxide
Internal lubricant	0.2	magnesium stearate

With the composition of the example, good processing characteristics and a Shore A hardness of 85 are attained. In addition, the antimicrobial properties of the composition are comparable to those in preceeding examples. Thermal ageing properties of the mixture are also especially good.

Example 4

Styrene based thermoplastic elastomer: SEBS blend

The example is directed to a basic SEBS blend. The combination PP/SEBS is generally used in those applications of styrene elastomers that are demanding with respect to working temperature and environmental pollution.

Raw material	% by weight	Products:
SEBS	30	Shell Kraton G-1651
$CaCO_3$	15	Omycarb 2A, OMYA
Polypropylene	13.4	Escorene PP 4152
Plastisizer 1	35	polydecene
Plastisizer 2	0	mineral oil
Antimicrobial compound	0.3	triclosan
Antioxidant	0.3	Irganox B-225

The ability to plastisize SEBS elastomers greatly depends on the styrene content thereof. An elastomer with a low styrene content accepts plastisizer more than 1.5 times its own weight. The antimicrobial properties of the exemplary mixture are comparable to those in examples 1 and 2.

Example 5

AATCC method 147 – 1998 (Antimicrobial Activity of Textile Materials: Parallel Streak Method) was used as the test method. Test microbes (*Staphylococcus aureus*) were cultivated on blood plates according to sensitivity assay technique. The preparates were placed in contact with the agar, and the plates were incubated at 35 °C over night. The bacteriostatic activity was assayed as the width of the inhibition zone around the sample or as reduced growth under the sample.

Table 1 Antimicrobial activity of elastomers

	EPDM	SEBS
Inhibition zone, mm	12	10
Inhibition zone, mm, 100 h at 125 °C	4	2
Inhibition zone, mm, 240 h at 125 °C	1	no growth under sample

The antimicrobial properties of the blend make it very suitable for instance for medical applications. Antimicrobial properties of the elastomers are not lost even after extended heat treatment.

Claims

1. Antimicrobial polyalphaolefin composition, **characterized** in that said composition comprises polyalphaolefin and 0.01 to 30 % by weight of 2,4,4'-trichloro-2'-hydroxyphenyl ether, and/or 0.01 % by weight of paraben as antimicrobial compounds.

2. Antimicrobial polyalphaolefin composition of Claim 1, **characterized** in that said polyalphaolefin is a hydrogenated polydecene.

3. Antimicrobial polyalphaolefin composition of Claim 1 or 2, **characterized** in that said composition comprises vitamin A and/or E.

4. Use of an antimicrobial polyalphaolefin composition of Claim 1 or 2 as a protecting and lubricating oil in food, technochemical, and pharmaceutical industries.

5. Use of an antimicrobial polyalphaolefin composition of Claims 1 to 3 in cosmetics industry, and the use thereof as a skin care oil, or on the skin in connection with the use of prostheses.

6. Use of an antimicrobial polyalphaolefin composition of Claim 1 or 2 for impregnation of wooden products and wood, and for the treatment and polishing of leather.

7. Use of an antimicrobial polyalphaolefin composition of Claim 1 or 2 as a plastisizer in rubber mixtures, thermoplastic elastomers, thermoplastic vulcanizates, and silicones to improve the antimicrobial properties thereof.

8. Process for producing rubber mixtures, thermoplastic elastomers, thermoplastic vulcanizates, and silicones, **characterized** in that an antimicrobial polyalphaolefin composition of Claim 1 or 2 is used as the plastisizer in said production.

9. Process of Claim 8, **characterized** in that said antimicrobial polyalphaolefin composition is added to said rubber mixtures, thermoplastic elastomers, thermoplastic vulcanizates, and silicones, optionally heated to a temperature between 10 and 90 °C, to the final concentration of 0.1 to 1.0 % by weight of 2,4,4'-trichloro-2'-hydroxyphenyl ether, and/or paraben in plastic product.

10. Process of Claim 8 or 9, **characterized** in that said thermoplastic elastomer is a PP/EPDM or PP/EPR blend or a styrene based thermoplastic elastomer, preferably a SEBS blend.

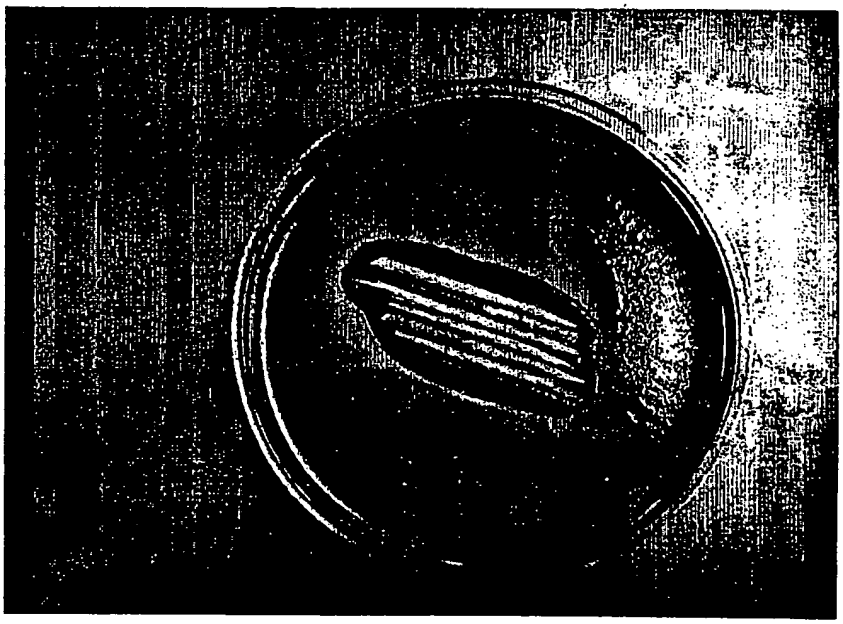

FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 01/00887

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A01N 25/00, A01N 31/16, A01N 37/40, A61K 7/00, A61K 7/48, B27K 3/38, B27K 3/40, A23L 3/34 A23 L 1/03, C14C 9/00, C14C 11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A01N, A61K, A23L, C14C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ, CHEM. ABS DATA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9937710 A1 (GEBR. OTTO KG), 29 July 1999 (29.07.99) --	1-10
X	US 5069907 A (GROVER C. MIXON ET AL), 3 December 1991 (03.12.91) --	1-10
X	WO 9927792 A1 (NOVAPHARM RESEARCH (AUSTRALIA) PTY. LTD.), 10 June 1999 (10.06.99) --	1-10
X	WO 9952362 A1 (PHOENIX MEDICAL TECHNOLOGY, INC.), 21 October 1999 (21.10.99) -- --------	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 March 2002	20 -03- 2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Gerd Strandell/EÖ Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/FI 01/00887

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